

Coastal Engineering Technical Note

SHORT TERM BIOLOGICAL EFFECTS OF NEAR-SHORE JETTY CONSTRUCTION

PROBLEM: Rubble structures are frequently located within estuarine and coastal systems; however, only a limited amount of information exists on the biological effects of such structures. Coastal structures may result in changes in wave and current patterns, sedimentation patterns and habitat types. These changes in turn affect aquatic biological communities. This note provides information for an environmental assessment of these biological effects.

BACKGROUND: Construction of the jetty system at Murrells Inlet (see Figure) provides an opportunity to study the biological impact of jetty construction. Murrells Inlet provides access to a biologically productive marshy lagoon. The area is known to be an important nursery ground for commercial species such as shrimp, blue crabs, black seabass, blue fish, sea trout, spot, and black and red drum. It is also one of the most intensively utilized coastal areas in South Carolina for sport fishing (Calder, Bearden, and Boothe, 1976). The north jetty was constructed between October 1977 and January 1979, and the south jetty was constructed between February 1979 and April 1980.

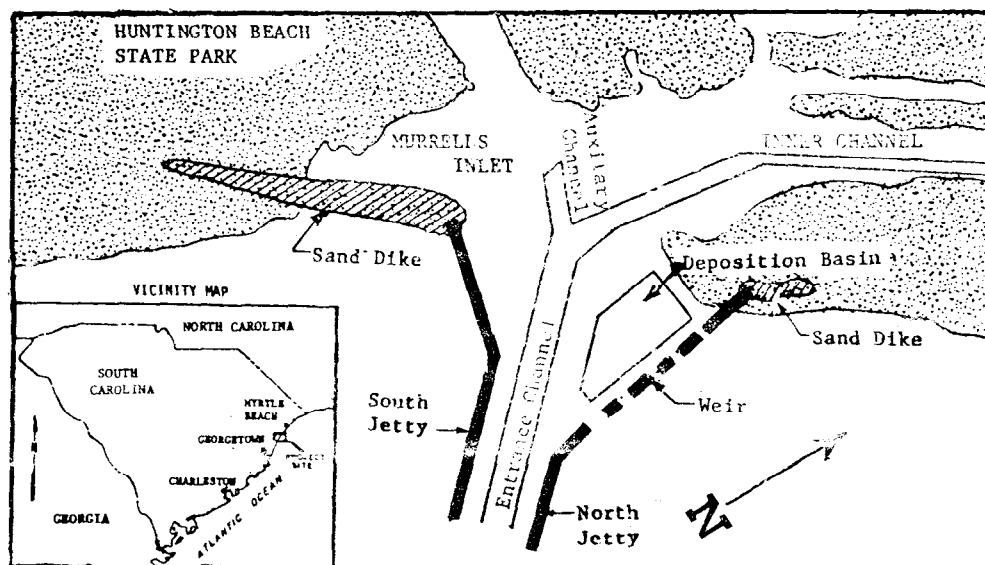


Figure. Murrells Inlet Weir Jetty

APPROACH: During construction of the north jetty, three transects along and adjacent to the jetty alignment were sampled (Calder and Knott, 1978). Three intertidal and three subtidal stations were chosen on each transect. Intertidally, stations were located at Mean High Water (MHW), Mean Tide Level (MTL) and Mean Low Water (MLW).

Qualitative and quantitative benthic sampling was undertaken at each of 18 stations along the transects during all four seasons from November 1977 to August 1978.

Community structure and distribution of attaching organisms on the jetty were assessed during the summer of 1979 (Calder, Dolah, and Knott, 1979). Three systematic sampling techniques were used to characterize epibenthic communities: (1) line transect census; (2) photographic quadrat census; and (3) suction sampling of motile species. Species composition, relative abundance, and distribution were obtained by comparing and integrating the data from all three sampling methods. Data on fish came from qualitative observations made during investigations on benthic organisms, baited black fish traps, and a beach seine pulled along the western side of the jetty. Fish species were also sampled using gill nets.

RESULTS: Before construction, differences in intertidal epibenthic community structure at a given elevation from one transect to another were relatively minor and attributable largely to differences in sediment texture. By February 1978, the north jetty extended several hundred feet offshore, sheltering all of the nearshore intertidal beach stations resulting in an increased number of species in the area due to reduced wave stress (see Table 1). Many of the initial species were eliminated by competition for suitable habitat; and by May, the community approached a new equilibrium. As the north jetty extended further seaward, species populations and diversity increased in the newly protected areas.

In August 1978 the jetty was still under construction and no effects on the fauna of the unsheltered areas adjacent to the construction were apparent. One year following completion of the north jetty, distinct vertical zonation patterns were apparent on jetty quarrrystones, especially in the intertidal zone. The upper intertidal zone was dominated by barnacles and blue green algae, whereas the lower intertidal zone was dominated by dense mats of mussels.

Table 1. Number of Species Before and After Construction of the North Jetty

Station Elevation (in meters, MLW)	November 1977		February 1978		May 1978		August 1978	
	N ^{1/}	S ^{1/}	N	S	N	S	N	S
<u>Intertidal</u>								
MHW	3	0	5	0	1	1	1	3
MTL	6	7	8	30	7	9	7	10
MLW	7	14	11	42	5	18	9	16
<u>Subtidal</u>								
- 1.0	20	19	28	16	25	24	18	28
- 2.0	22	23	33	22	35	22	22	34
- 5.0	27	33	65	53	49	48	50	34

NOTE: Stations affected by jetty construction are to the right of the double line.

^{1/} N and S refer to the north and south side of the jetty. The north side is exposed, whereas the south side is sheltered.

Other important species in the intertidal zone included oysters, barnacles, various algae, and an isopod. Species composition was more varied in subtidal waters, consisting of mussels, algae, crustaceans, worms, starfish, and numerous attaching organisms.

Although algal species were observed higher in the intertidal zone on the exposed north side of the weir jetty, animals were more prevalent on the quarry-stones of the sheltered south side. Table 2 shows that greater numbers (as reflected by percent cover) and kinds of organisms were observed on the inshore quarrystones placed in July 1978 (after 1 year exposure) compared to the off-shore quarrystones placed in November 1978 (after 8 months exposure).

Table 2. Species Data Summary for the Exposed and Sheltered Side of N. Jetty

Species Level (in Meters, MLW)	No. of Species				% Cover				% Unoccupied			
	8 Months		1 Year		8 Months		1 Year		8 Months		1 Year	
	N ^{1/}	S ^{1/}	N	S	N	S	N	S	N	S	N	S
<u>Intertidal</u>												
+ 2.5	0	0	0	0	0	0	0	0	100	100	100	100
+ 2.0	0	1	2	1	0	12	51	35	100	88	49	65
+ 1.5	4	2	3	2	96	47	56	47	4	53	44	53
+ 1.0	4	1	4	4	75	55	71	83	25	45	29	17
+ 0.5	4	5	4	3	71	53	81	75	9	47	19	25
MLW	6	7	4	7	99	93	80	84	1	7	20	16
<u>Subtidal</u>												
- 1.0	10	9	10	10	95	95	79	67	5	5	21	33
- 2.0	10	11	^{2/}	^{2/}	79	92	^{2/}	^{2/}	21	8	^{2/}	^{2/}

^{1/} N and S refer to the North and South side of the jetty. The north side is exposed and the south side is sheltered.^{2/} Not sampled since depth at location was less than -2.0m, MLW.

These differences were attributed to a four-month exposure period of the structure at inshore sites, and to different stages of community development.

The north jetty has been colonized by a great variety of attaching organisms and fish. Sampling revealed 152 species of plants and animals on or associated with the jetty. Large numbers of juvenile black seabass were using the structure as a nursery ground, and other species such as sheepshead and spadefish were attracted to the quarrrystones. Twenty-two major fish species, observed at or near the north jetty, include Atlantic sharpnose shark, rays, Atlantic menhaden, threadfin shad, striped anchovy, black seabass, blue fish, Atlantic bumper, Florida pompano, pigfish, sheepshead, pinfish, spotted seatrout, spot, Atlantic spadefish, butterfish, mullet, southern stargazer, feather blenny, Spanish mackerel, southern flounder, and northern puffer.

CONCLUSIONS: The weir jetty had a detectable impact at only four of the 18 benthic stations adjacent to the structure. Jetty construction was accompanied by an increase in the number of species and by changes in benthic community structure at the four sheltered stations. These changes resulted from modification of the environment immediately south of the weir jetty from a high to a low wave energy area. The only negative impacts of the jetty construction on the macrobenthos included (1) the elimination of communities directly in the path of the jetty construction, and (2) disruption of communities due to dredging of the entrance channel and deposition basin.

Although colonization of the quarrrystone structure has been rapid during the first year, biotic communities appeared to be in an early stage of development, particularly at the seaward end of the jetty.

The quarrrystone jetty provided habitat for 152 species of plants and animals and 22 species of fishes.

ADDITIONAL INFORMATION: Contact the CERC Coastal Ecology Branch (202) 325-7393.

REFERENCES:

- CALDER, D.R., BEARDEN, C.M., and BOOTH, B.B., JR., "Environmental Inventory of Small Neutral Embayment: Murrells Inlet, South Carolina," South Carolina Marine Resources Center, South Carolina Wildlife and Marine Resources Department, Charleston, South Carolina, Technical Report No. 10, 1976, 58 pp.
- CALDER, D.R., and KNOTT, D.M., "A Study of the Ecological Effects of Rubble Weir Jetty Construction at Murrells Inlet, South Carolina," Marine Resources Research Institute, South Carolina Wildlife and Marine Resources Department, Charleston, South Carolina, Agreement Number W74RDV CERC 77-59, Draft Final Report, December 1978, 163 pp.
- CALDER, D.R., VAN DOLAH, R.F., and KNOTT, D.M., "A Study of the Ecological Effects of Rubble Weir Jetty Construction at Murrells Inlet, South Carolina," Marine Resources Research Institute, South Carolina Wildlife and Marine Resources Department, Charleston, South Carolina 29412, Agreement Number W74RDV CERC 77-59, 1979 Summary Report, October 1979.